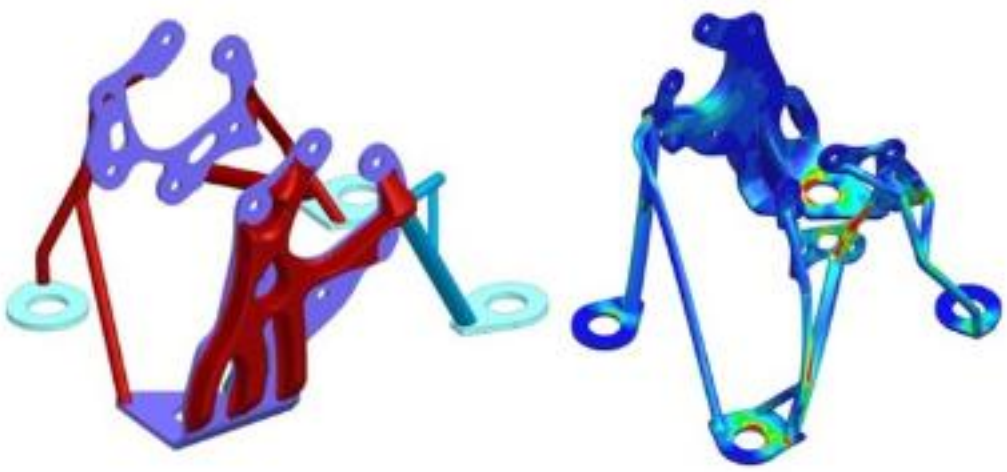
Llightweight aluminium construction: integrated process network combines laser processes

About this project



RESILIENT

Llightweight aluminium construction: integrated process network combines laser processes

Markets:

Material: Aluminium

This project is funded by the Technology Transfer Programme Leichtbau (TTP LB) of the Federal Ministry of Economics and Energy.

Technology Transfer Program Leichtbau

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Context

Reducing greenhouse gas emissions is one of the biggest challenges facing industry. In vehicle and mechanical engineering in particular, the mass of components determines how much energy is required during operation - and therefore how high the CO# emissions are. Lightweight construction offers an effective lever here, but the production of such components requires complex processes and often a high use of resources.

Aluminium is a particularly attractive material: it weighs around two thirds less than steel and is easy to recycle. However, its processing is technically demanding, energy-intensive and often involves material losses. Laser-based manufacturing processes such as cutting, welding and cladding promise a more resource-efficient alternative because they work precisely and can combine several processing steps. However, their potential has so far been insufficiently utilised in industrial practice. The researchers in the RESILIENT project want to close this gap.

Purpose

The project team wants to show that a new production method for lightweight aluminium components can save considerable amounts of greenhouse gases. The centrepiece is the development of a multi-tool process with which the researchers combine laser cutting, laser welding and laser deposition welding in an integrated process network. In this way, they want to replace conventional, energy- and material-intensive routes.

The researchers are not only making the production steps more efficient, but also enabling emission-optimised decisions to be made as early as the design phase. Design guidelines and a software-supported selection tool should ensure that industrial and, in particular, small and medium-sized companies can choose the best production path for their requirements - taking into account the carbon footprint, material consumption and costs.

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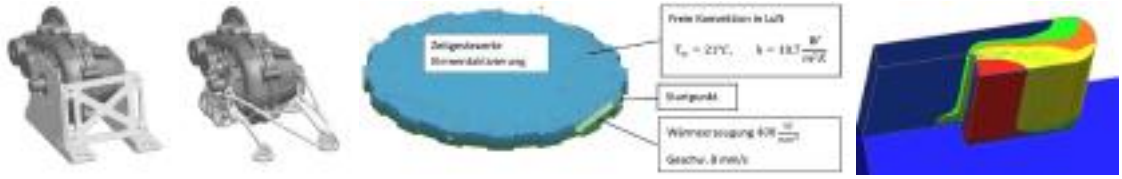
Procedure

The researchers are linking different laser processes in an adaptive process network for the first time. To do this, they are recording real energy and material flows and comparing them with conventional production methods. At the same time, they are further developing laser technologies for aluminium - for example with new diode lasers with higher efficiency and adapted wavelengths that require less power and improve material absorption.

In addition, a software tool is being developed that calculates the optimum production path based on weighting criteria such as CO# emissions, construction time or costs. Digital twins of components and processes are used to predict distortion and precisely coordinate processing steps.

The project team uses real demonstrators to test how bionically designed lightweight components can be produced in a resource-efficient manner.



Funding duration:

Funding sign: 03LB2057 **Funding amount:** EUR 2 million

Final report

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB2057A - RESILIENT in the federal funding catalogue

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Project coordination

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English (EN){{ Projektpartner }}

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Lightweighting classification

	Realisation
Offer	
Products Parts and components, Software & databases	✓
Services & consulting Engineering, Simulation	✓
Field of technology	
Design & layout Lightweight manufacturing, Lightweight design	✓
Functional integration	
Measuring and testing technology	
Modelling and simulation Life-cycle analysis, Optimisation, Processes	✓
Plant construction & automation	
Recycling technologies	
Manufacturing process	
Additive manufacturing 3D printing, Deposition welding, Selective laser melting (SLM, LPBF, ...)	✓
Coating (surface engineering)	
Fibre composite technology	
Forming	
Joining	
Material property alteration	
Primary forming	
Processing and separating Cutting	✓
Textile technology	

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Lightweighting classification

	Realisation
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites	
Fibres	
Functional materials	
Metals Aluminium	✓
Plastics	
Structural ceramics	
(Technical) textiles	